

WE CLAIM:

1. An aqueous red blood cell storage solution comprising sodium citrate, sodium biphosphate, sodium phosphate dibasic, adenine, and mannitol, and having a pH of approximately 7.4.
2. The aqueous red blood cell storage solution of Claim 1 having an osmolarity of less than 300 mOsm/l.
3. The aqueous red blood cell storage solution of Claim 1 including guanosine.
4. The aqueous red blood cell storage solution of Claim 1 including citric acid.
5. An aqueous red blood cell storage solution comprising sodium citrate, sodium biphosphate, sodium phosphate dibasic, adenine, and mannitol, and having an osmolarity of less than 300 mOsm/l.
6. The aqueous red blood cell storage solution of Claim 5 including dextrose.
7. The aqueous red blood cell storage solution of Claim 5 including guanosine.
8. The aqueous red blood cell storage solution of Claim 5 including citric acid.
9. An aqueous red blood cell storage solution comprising a first distinct solution and a second distinct solution wherein:
 - the first solution includes in millimolar concentration (mmol/l) approximately 20 mmol/l to about 140 mmol/l of at least one sugar chosen from the group consisting of dextrose and fructose;
 - the second solution includes in millimolar concentrations:
 - approximately 1 mmol/l to about 2.2 mmol/l adenine;
 - approximately 20 mmol/l to about 110 mmol/l mannitol;

approximately 2.2 mmol/l to about 90 mmol/l sodium citrate;

approximately 1 mmol/l to about 10 mmol/l sodium biphosphate;

5 approximately 5mmol/l to about 25 mmol/l sodium phosphate dibasic; and

approximately 0 mmol/l to about 2 mmol/l guanosine.

10. The aqueous red blood cell solution of Claim 9 wherein the second solution includes approximately 0.4 to about 15 mmol/l of citric acid.

11. The aqueous red blood cell solution of Claim 9 wherein the second solution has a pH of approximately 7.4.

12. The aqueous red blood cell solution of claim 9 wherein the total volume of solution is approximately 50 to about 200 ml.

13. A two part aqueous red blood cell storage solution comprising:

20 a first part including sodium citrate, sodium biphosphate, sodium phosphate dibasic, adenine, and mannitol; and

a second part including a sugar chosen from the group consisting of dextrose and fructose.

14. The two part aqueous red blood cell storage solution of Claim 13 wherein the first part includes guanosine.

15. The two part aqueous red blood cell storage solution of Claim 13 wherein the first part is stored in a first container and the second part is stored in a second container.

16. The two part aqueous red blood cell storage solution of Claim 13 wher in th first and second parts

are stored in separate elements of a multiple element container.

17. The two part aqueous red blood cell storage solution of Claim 13 wherein the pH of the first part is
5 approximately 7.4.

18. An aqueous red blood cell storage solution comprising in millimolar concentration (mmol/l):

10 approximately 30 mmol/l to about 60 mmol/l of at least one sugar chosen from the group consisting of dextrose and fructose;

15 approximately 1.2 mmol/l to about 1.7 mmol/l adenine;

approximately 30 mmol/l to about 50 mmol/l mannitol;

15 approximately 4.5 mmol/l to about 55 mmol/l sodium citrate;

approximately 2 mmol/l to about 5 mmol/l sodium biphosphate;

approximately 8 mmol/l to about 18 mmol/l sodium phosphate dibasic; and

20 approximately 0 mmol/l to about 1.5 mmol/l guanosine.

19. The aqueous red blood storage solution of Claim 18 wherein the total volume of solution is approximately 75 to about 150 ml.

25 20. The aqueous red blood cell storage solution of Claim 18 including approximately 0.8 to about 9.5 mmol/l of citric acid.

21. An aqueous red blood cell storage solution comprising in millimolar concentration (mmol/l):

30 approximately 1.0 mmol/l to about 2.2 mmol/l adenine;

approximately 20 mmol/l to about 110 mmol/l mannitol;

approximately 2.2 mmol/l to about 90 mmol/l sodium citrate;

approximately 1 mmol/l to about 10 mmol/l sodium biphosphate;

5 approximately 5 mmol/l to about 25 mmol/l sodium phosphate dibasic; and

approximately 0 mmol/l to about 2.0 mmol/l guanosine; and having a pH of approximately 7.4.

10 22. The aqueous red blood cell storage solution of Claim 21 wherein the osmolarity is less than approximately 300 mOsm/l.

15 23. A method of storing red blood cells comprising the step of combining a plasma depleted collection of red blood cells with an aqueous storage solution comprising sodium citrate, sodium biphosphate, sodium phosphat dibasic, adenine, and mannitol, and having an osmolarity of less than 300 mOsm/l.

24. The method of Claim 23 wherein the storage solution includes guanosine.

20 25. The method of Claim 23 wherein the storage solution comprises in millimolar concentration (mmol/l):

approximately 20 mmol/l to about 140 mmol/l of at least one sugar chosen from the group consisting of dextrose and fructose;

25 approximately 1 mmol/l to about 2.2 mmol/l adenine; approximately 20 mmol/l to about 110 mmol/l mannitol;

approximately 2.2 mmol/l to about 90 mmol/l sodium citrate;

30 approximately 1 mmol/l to about 10 mmol/l sodium biphosphat ;

approximately 5mmol/l to about 25 mmol/l sodium phosphate dibasic; and

approximately 0 mmol/l to about 2 mmol/l guanosine; per 100 ml of solution.

26. The method of Claim 23 wherein the storage solution comprises in millimolar concentration (mmol/l):

5 approximately 1.0 mmol/l to about 2.2 mmol/l adenine;

 approximately 20 mmol/l to about 110 mmol/l mannitol;

10 approximately 2.2 mmol/l to about 90 mmol/l sodium citrate;

 approximately 1 mmol/l to about 10 mmol/l sodium biphosphate;

 approximately 5 mmol/l to about 25 mmol/l sodium phosphate dibasic; and

15 approximately 0 mmol/l to about 2 mmol/l guanosine; per 100 ml of solution.

27. A method for storing red blood cells comprising the steps of:

 adding an anticoagulant to collected whole blood having a sufficient level of dextrose to provide a nutrient supply to separated red blood cells;

 separating the red blood cells from the whole blood; and

25 adding to the separated red blood cells an aqueous storage solution comprising sodium citrate, sodium biphosphate, sodium phosphate dibasic, adenine, and mannitol.

28. The method of Claim 27 wherein the pH of the storage solution is 7.4.

30 29. The method of Claim 27 wherein the storage solution comprises in millimolar concentration (mmol/l): approximately 1 mmol/l to about 2.2 mmol/l adenine;

approximately 20 mmol/l to about 110 mmol/l mannitol;

approximately 2.2 mmol/l to about 90 mmol/l sodium citrate;

5 approximately 1 mmol/l to about 10 mmol/l sodium biphosphate;

approximately 5 mmol/l to about 25 mmol/l sodium phosphate dibasic; and

10 approximately 0 mmol/l to about 2 mmol/l guanosine; per 100 ml of solution.

30. The method of Claim 27 wherein the anticoagulant has a reduced citrate level.

31. The method of Claim 27 wherein the solution includes citric acid.

15 32. The method of Claim 27 wherein the aqueous storage solution has an osmolarity of less than 300 mOsm/l.

20 33. A method of storing red blood cells comprising the step of combining a plasma depleted collection of red blood cells with an aqueous storage solution comprising sodium citrate, sodium biphosphate, sodium phosphate dibasic, adenine, and mannitol, and having a pH of approximately 7.4.

34. The method of Claim 33 wherein the storage 25 solution includes guanosine.

35. The method of Claim 33 wherein the storage solution comprises in millimolar concentration (mmol/l):

approximately 1 mmol/l to about 2.2 mmol/l adenine;

approximately 20 mmol/l to about 110 mmol/l 30 mannitol;

approximately 2.2 mmol/l to about 90 mmol/l sodium citrate;

approximately 1 mmol/l to about 10 mmol/l sodium biphosphate;

approximately 5 mmol/l to about 25 mmol/l sodium phosphate dibasic; and

5 approximately 0 mmol/l to about 2 mmol/l guanosine; per 100 ml of solution.

36. A two part aqueous red blood cell storage solution comprising:

10 a first part including at least, sodium biphosphate and sodium phosphate dibasic;

a second part including at least a sugar chosen from the group consisting of dextrose and fructose; and

at least one of the first and second parts including mannitol, sodium citrate, and adenine.